LIMITED CIRCULATION

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Monitoring the temperatures in a chick-transporter lorry.

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Agricultural Memorandum No 1068

SUMMARY

The Memorandum illustrates the use of a data logger in 'tuning' the environment of the chick-holding room at a Welsh hatchery and in monitoring the conditions in a chick-transporter lorry.

Two daily batches of about 30,000 day-old chicks are transported on four days each week from a hatchery in Wales to nearby farms where they are grown to mature broilers.

The loading, transit and unloading period lasts the morning and the hatching manager and the ADAS Poultry Adviser were concerned about possible heat (or cold) stress imposed on the chicks. A "Squirrel" data logger was installed in a lorry to monitor temperature over what turned out to be a particularly warm period in September/ October 1985.

Introduction

Homeotherms can regulate their thermal exchanges with the environment satisfactorily while that environment is maintained within an appropriate 'thermoneutral zone TZ' (assuming adequate food and water are available).

TZ (a function of feed level and breed for a particular class of livestock) is particularly narrow (a few °C) for young stock. The maintenance of a satisfactory environment can be particularly difficult for classes of stock which do not have a sweating ability such as pigs and poultry.

Broilers, for example, under certain crowded conditions, could suffer from hyperthermia under quite moderate environmental temperatures (~ 20°C).

For young chicks the temperature environment will be even more critical. (TZ is only a degree or so wide); in the chick-holding room temperatures were maintained in a recommended range of 21-24°C at about 70% relative humidity.

This environment had earlier been monitored with the logger and 'tuned'; the studies indicated improved temperature control and a humidifier to be necessary. After the installation of the humidifier, chick losses have dropped from up to 4% to 1 to 2% - and 60,000 chicks are hatched a day, with a value of 10p per chick - a saving of up to £250 per week (Figs 1, 2).

The value of these studies in the chick holding room to the hatching manager is clearly established; the temperature environment of the lorry transporting the day-old chicks had not been studied and could clearly impose 'stresses' on the chicks if the temperature rose above the upper critical temperature (ie ~ 33°C) (or conversely fell below a lower critical temperature) for any length of time.

Instrumenting the lorry

Temperature probes were fixed to the interior walls of the lorry, two at 1½m above the floor (on the near and offside) and one at ½m at the cab end (height chosen to avoid damage to the probe by chick crates). (See fig 3.a, b + c)

The external temperature was monitored by a probe taped to the inside surface of a wooden batten in a recess panel on the 'near side' external wall; the leads from the 3 internal probes were led out through the same recess. All four leads were taped together, brought into the cab and plugged into the 4-channel 'Squirrel' logger which was then placed in its metal protective box inside the cab glove-box.

Data recording, at 15 minute intervals, was commenced on Friday 20 September 1985 after the morning chick delivery. The logger was off-loaded to the Epson HP-20 microprocessor two weeks later on 4 October.

Chicks were not transported on Wednesdays or at weekends.

Temperature traces

This period was particularly warm for the time of year; maximum temperatures at the (coastal) Valley site reached over 22°C on 27 and 28 September (and 20°C or close between 29 September and 1st October); corresponding interior lorry wall temperature attained 29.2°C on 27th and 30.2°C on the 26th.

The traces (fig 4) on chick transporting days (Mondays, Tuesdays, Thursdays, and Fridays) are characterised by a rapid rise in internal temperature from about 10am as chicks were loaded. Temperature 'spikes' probably correspond to the periods when the lorry is parked to off-load chicks or collect the second load. (Ventilation by 'ram' effect in transit or by fan when stationary; deliveries were generally completed by 2pm.)

A further study with a recording interval of a few seconds, temperature probes within the chick boxes and the delivery characteristics monitored by a meteorologist travelling in the lorry, is clearly necessary. It may then be possible to relate mortality data (Table 1) to thermal events within the delivery lorry. Cold and warm transit days should both be studied.

ACKNOWLEDGEMENTS

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All comments and questions should be referred to the author.

References:

Cochrane J (1984) Heat Stress in Broiler Chickens
Agricultural Memorandum 1013

Roe C P (1985) 'Trouble Shooting' in an egg storage room
Agricultural Memorandum 1057

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TABLE 1

Chick mortality:

The following are data on percentage chick mortality in the 10 days after delivery to farms.

Date of delivery 1985		% Mortality in various houses A	B	C	D
September	23	5.86	1.94	1.51	-
	24	1.27	3.62	1.62	0.58
	26	0.72	0.88	1.34	1.01
	27	0.94	0.91	1.47	-
	30	1.39	1.39	1.51	-
October	1	2.42	2.08	2.61	2.39
	3	1.43	1.21	1.06	2.22
	4	1.06	0.92	1.04	-

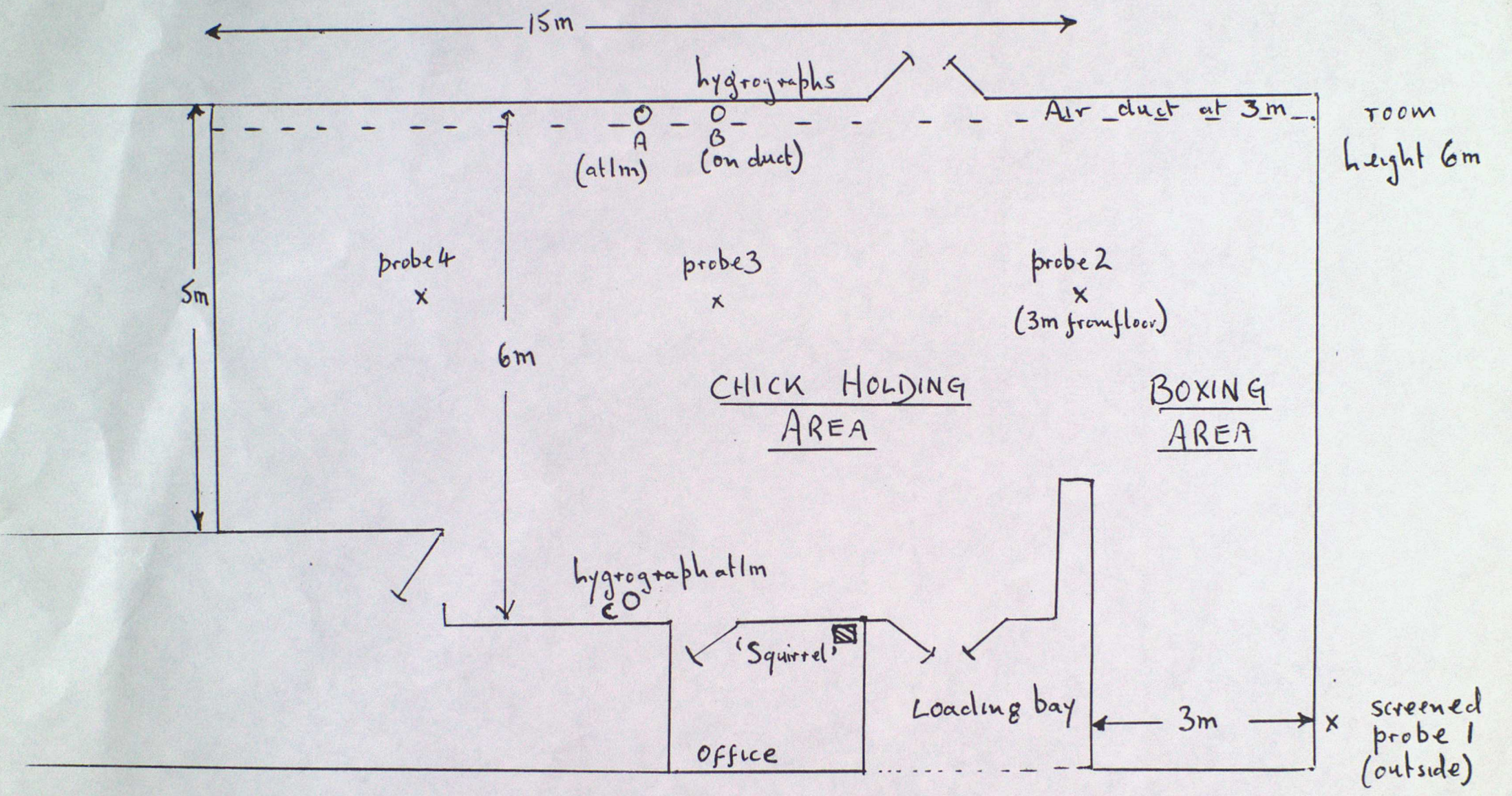

15m
hygrographs
A
(at 1m)
B
(on duct)
Air duct at 3m
room
height 6m
probe 4
x
probe 3
x
probe 2
x
(3m from floor)
5m
6m
CHICK HOLDING
AREA
BOXING
AREA
hygrograph at 1m
'Squirrel'
Loading bay
3m
x
screened
probe 1
(outside)
office

Fig 1.

Figs 2 a, b, c and d: successive stages in tuning the chick-holding environment.

a. Section of temperature trace (originally 6/9/85-20/9/85) showing poor temperature control within chick-holding area on Mondays, Tuesdays, Thursdays and Fridays (9/10th, 12/13th) when chicks were brought in from incubators.

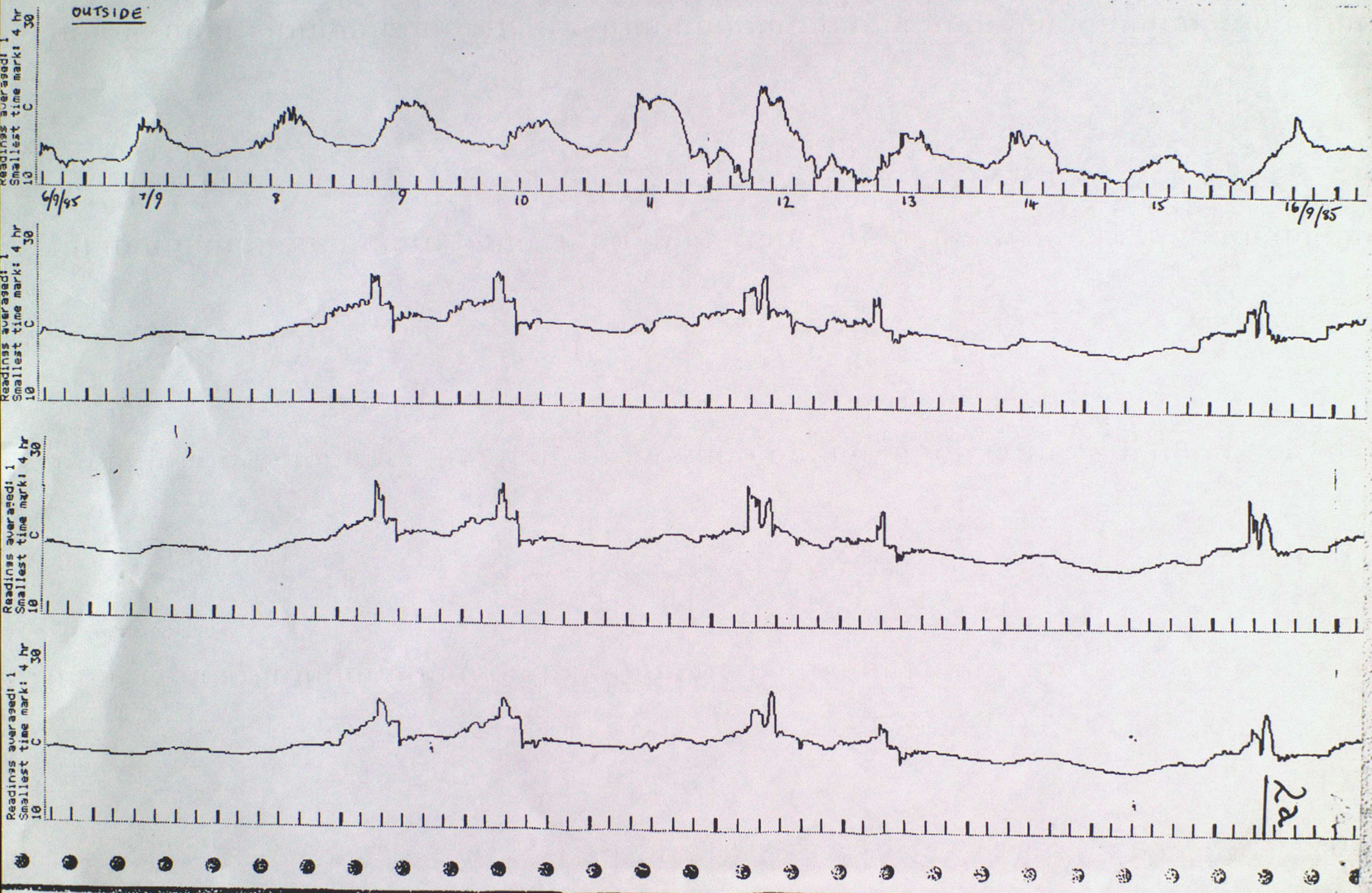
b. Temperature control and level improved by movement of and adjustment to the thermostat.

c. Humidifier introduced in November 1985.
Better temperature control (but note standard deviation of 4°C registered in Channel 2 so there is still room for further tuning).

d. i. Poor humidity control on chick-holding days (Monday, Tuesday, Thursday, Friday) in October.

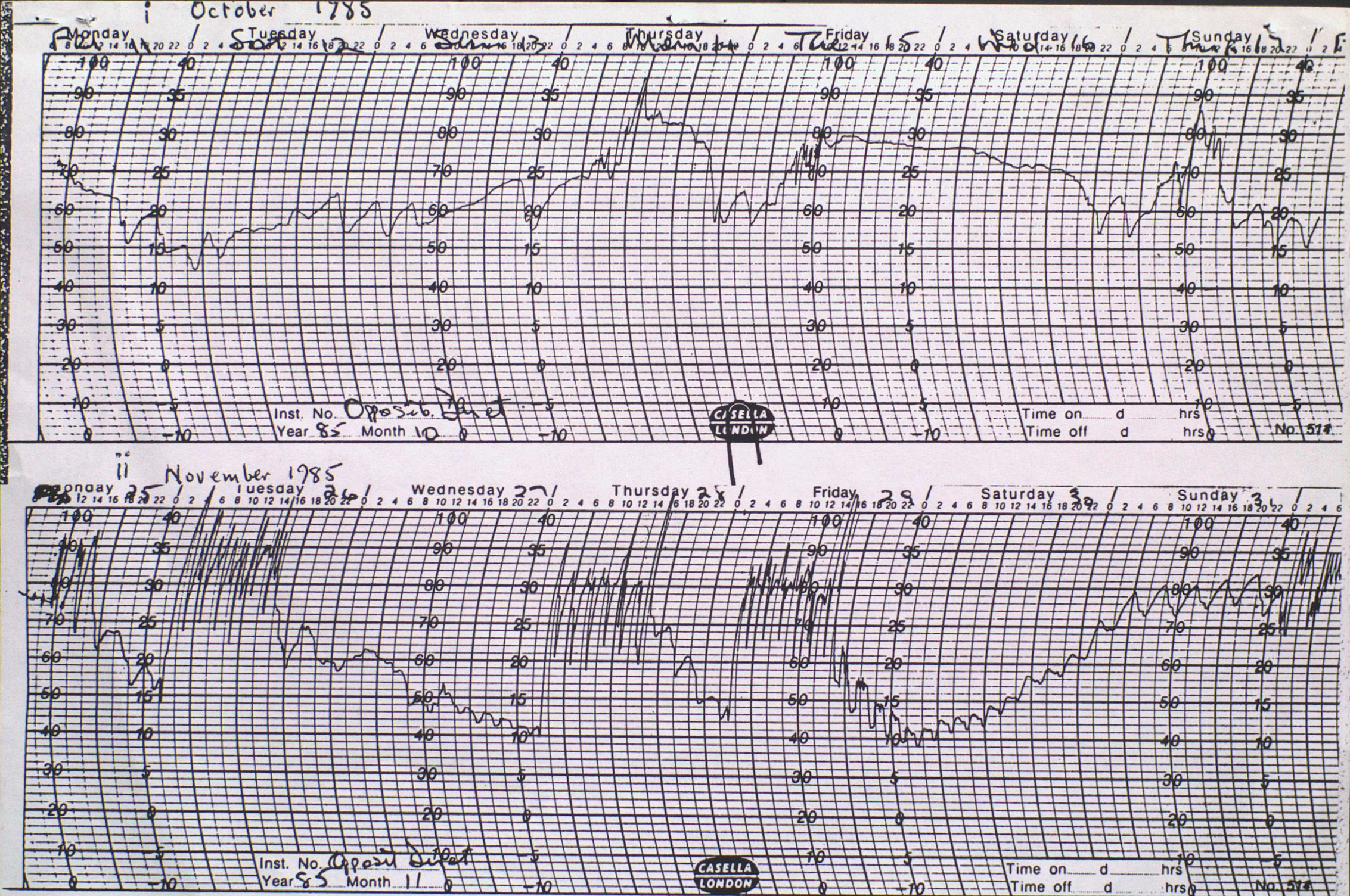
ii. Improved control at around 70% after the humidifier was introduced.

OUTSIDE


Readings averaged: 1
Smallest time mark: 4 hr
30
C
10
6/9/85
7/9
8
9
10
11
12
13
14
15
16/9/85
Readings averaged: 1
Smallest time mark: 4 hr
30
C
10
Readings averaged: 1
Smallest time mark: 4 hr
30
C
10
Readings averaged: 1
Smallest time mark: 4 hr
30
C
10
24

OUTSIDE
Readings averaged 1
Smallest time mark 4 hr
0 5 10 C 20 25
NEAR BOILER
Readings averaged 1
Smallest time mark 4 hr
0 5 10 C 20 25 30 35
mdnt
Fri. 4th oct. 1985
S 5th S 6th M 7th T 8th W 9th T 10th F 11th S 12th S 13th M 14th T 15th W 16th T 17th F 18th S 19th S 20th M 21st T 22 W 23rd T 24th F 25th
Each interval = 4 hours
MIDDLE
Readings averaged 1
Smallest time mark 4 hr
0 5 10 C 20 25 30
17.0
FAR END
Readings averaged 1
Smallest time mark 4 hr
0 5 10 C 20 25 30
17.4

DECEMBER 1985
NEAR BOILER
MIDDLE
FAR END
OUTSIDE
Channel 4
Readings averaged: 1
Smallest time mark: 4 hr
Mean: 19
Standard
2.6
Channel 3
Mean: 19
Standard
2.8
Channel 2
Mean:
Standa
4
Channel 1
35
0
C
30
-5
TUE 3 WED 4 THU 5 FRI 6 SAT 7 SUN 8 MON 9 TUE 10 WED 11 THU 12 FRI 13 SAT 14 SUN 15 MON 16 TUE 17 WED 18 THU 19 FRI 20 SAT 21 SUN 22 MON 23 TU
2c



Hygrographs at C in Fig 1

22

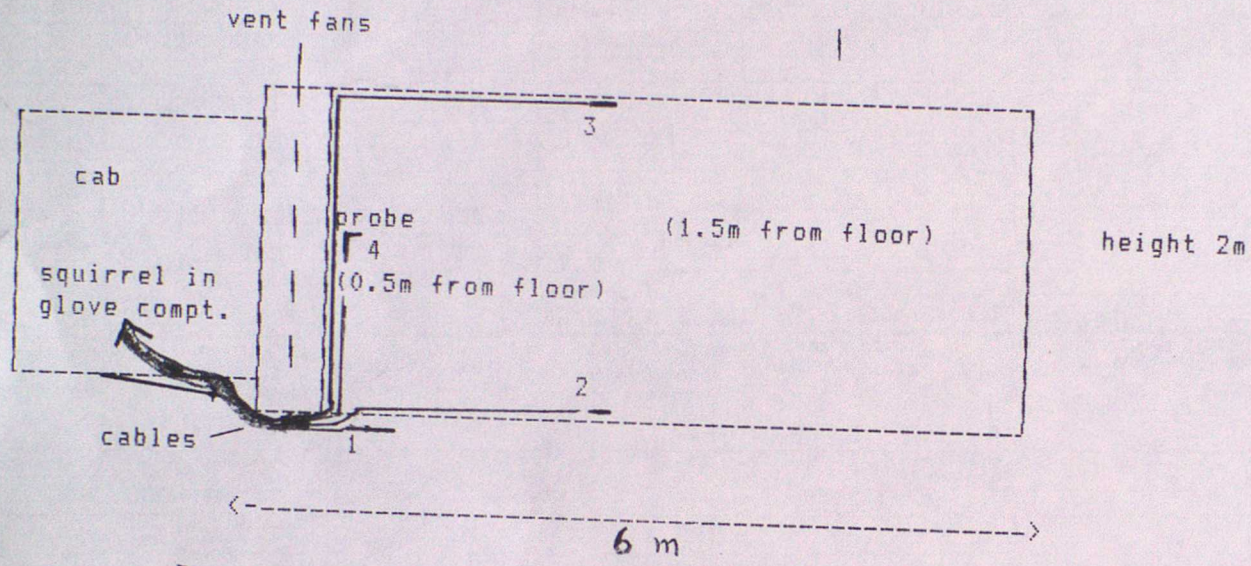
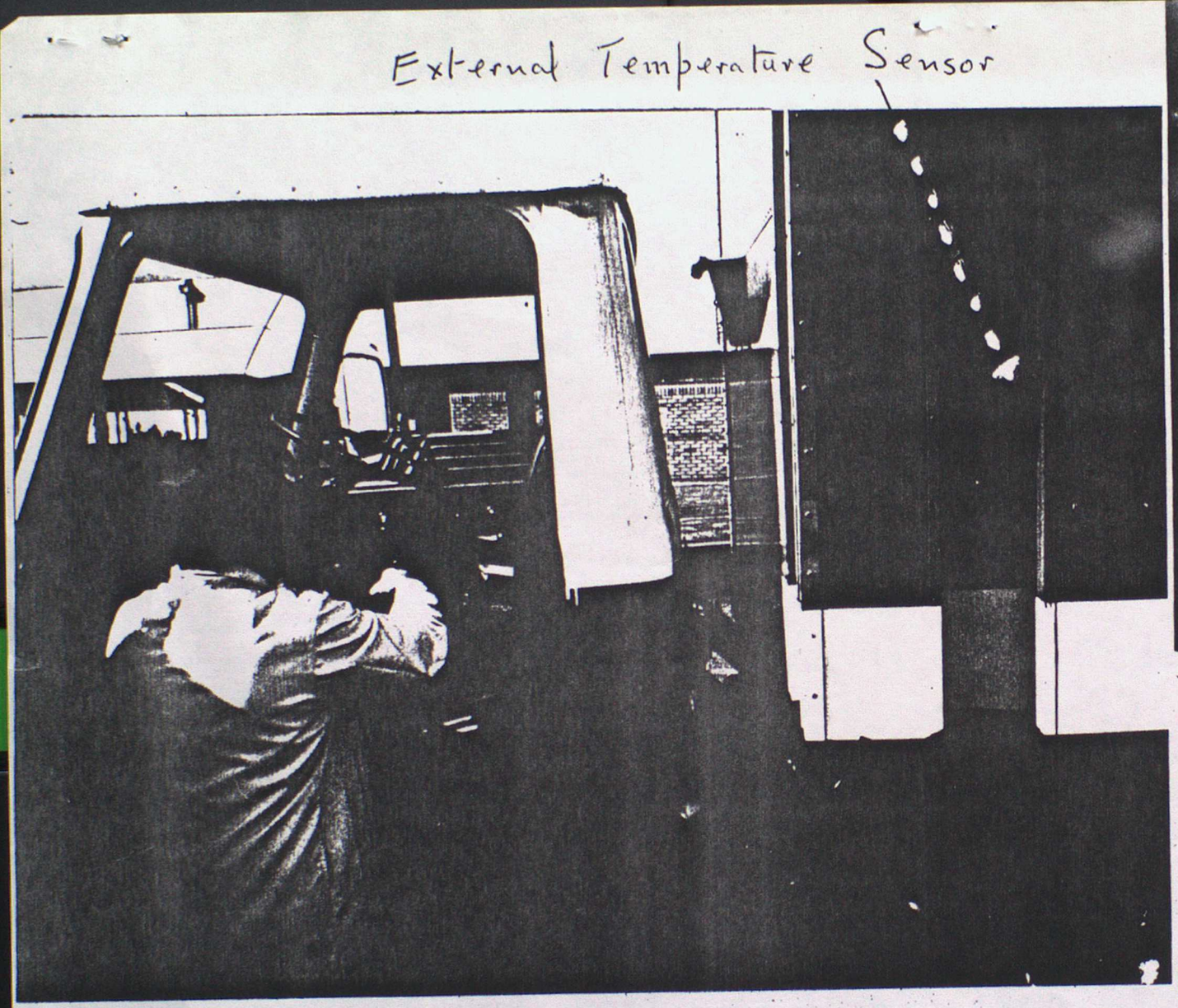

vent fans
cab
squirrel in
glove compt.
probe
4
(0.5m from floor)
3
(1.5m from floor)
height 2m
2
cables
1
6 m

Fig 3a

External Temperature Sensor



3b Installing Data-Logger in cab

3c Checking internal wall sensor (N°3)

	fri	sat	sun			wed		fri	sat				wed	
SEPT.	20	21	22	23	24	25	26	27	28	29	30	OCT 1	2	3

1985

DATA AT 15 MIN INTERVALS